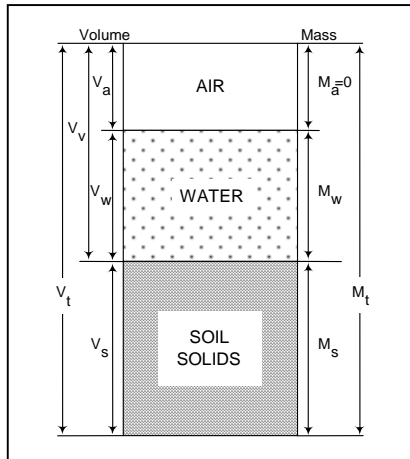


## DETERMINATION OF MOISTURE IN SOILS BY MEANS OF CALCIUM CARBIDE GAS PRESSURE MOISTURE TESTER

### FOP FOR AASHTO T 217



Phase diagram



### Significance

Moisture content of soils is a significant parameter in compaction. Soil is best compacted at or near what is called optimum moisture content. Soils that are too dry will need to have water added. Soils that are too wet will need to be dried prior to compacting. For these reasons, moisture content must be determined in the field in a timely manner.

This test procedure is particularly useful in the field in that the apparatus used is portable and no utilities are required. The "Speedy Moisture Tester," as the equipment is known, quickly determines moisture content as part of a chemical reaction between water and calcium carbide.

### Scope

This procedure uses a calcium carbide gas pressure moisture tester to determine the moisture content of soils in accordance with AASHTO T 217. This FOP does not apply to the Super 200 D tester (see AASHTO 217).

**CAUTION:** This procedure involves a potentially dangerous chemical reaction. When calcium carbide reacts with water, acetylene gas is produced. Breathing the acetylene gas and running the test where potential for sparks or other ignition might cause a fire must be avoided.

### Apparatus

- Calcium carbide gas pressure moisture tester
- Balance or scale, conforming to the requirements for AASHTO M 231 and having a capacity of 2 kg and sensitive to 0.1 g. Most testers include a balance built into the transportation container.

- Cleaning brush and cloth.
- Scoop (or cap built into unit) for putting the soil sample into the pressure chamber. Some testers include a cap built into the unit.
- Steel balls, 1.25" diameter

### Material

- Calcium carbide reagent meeting the requirements of AASHTO T 217.

**Note 1:** Check the manufacturer's recommendations for maximum storage life and replacement, and storage requirements. A change in color is an indicator of age.

### Procedure

1. With the moisture tester in a horizontal position place three scoops, approximately 24 g, of calcium carbide, into the body.
2. Place two steel balls into the body of the tester with the calcium carbide.
3. Obtain a sample of soil of the wet mass specified by the manufacturer, using the balance built into the unit, and place the soil into the cap of the tester.

**Note 2:** This method shall not be used on granular material having particles large enough to affect the accuracy of the test. In general, no + No. 4 material.

**Note 3:** If the anticipated moisture content exceeds the capacity of the instrument being used, then one-half of the specified soil mass should be placed into the unit, and the resulting gauge reading multiplied by two.

4. With the instrument in a horizontal position, so that calcium carbide does not come into contact with the soil, seat the cap on the body and tighten down on the clamp, thereby sealing the tester.

5. Carefully turn the unit to vertical and gently tap to allow the soil to fall from the cap into the pressure vessel. Do not allow the steel balls to strike the bottom of the pressure vessel.

6. Return vessel to horizontal position. Create a circular motion that causes the steel balls to roll

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Adding calcium carbide



Adding soil



**Sealing Tester**



**Reading gauge**



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around the interior perimeter of the vessel. Do not allow the steel balls to hit the cap or the bottom of the pressure vessel. Continue this motion vigorously for 60 seconds, then rest for 30 seconds. Repeat motion and resting cycles a minimum of three times or until no further reaction occurs.

7. Allow time for the dissipation of the heat generated by the chemical reaction.
8. When the gauge needle stops moving, take a reading while holding the unit in a horizontal position at eye level.
9. Record the sample mass and the gauge reading.
10. Position the unit so that the cap is away from the user and slowly loosen the clamp to release the gas from the pressure chamber. Inspect the sample inside the pressure chamber. If it is not completely pulverized, a new sample must be obtained and tested after the instrument has been thoroughly cleaned.

### Moisture Determination

1. The tester determines moisture content based on the wet mass of the soil. Moisture content based on the dry mass of soil is obtained from a conversion chart or curve supplied with each tester. See Figure 1 for curve from AASHTO T 217.

**Note 4:** Check the accuracy of the gauge and the conversion chart or curve periodically, in accordance with agency requirements, by testing samples of a known moisture content. Develop correction factors, if necessary.

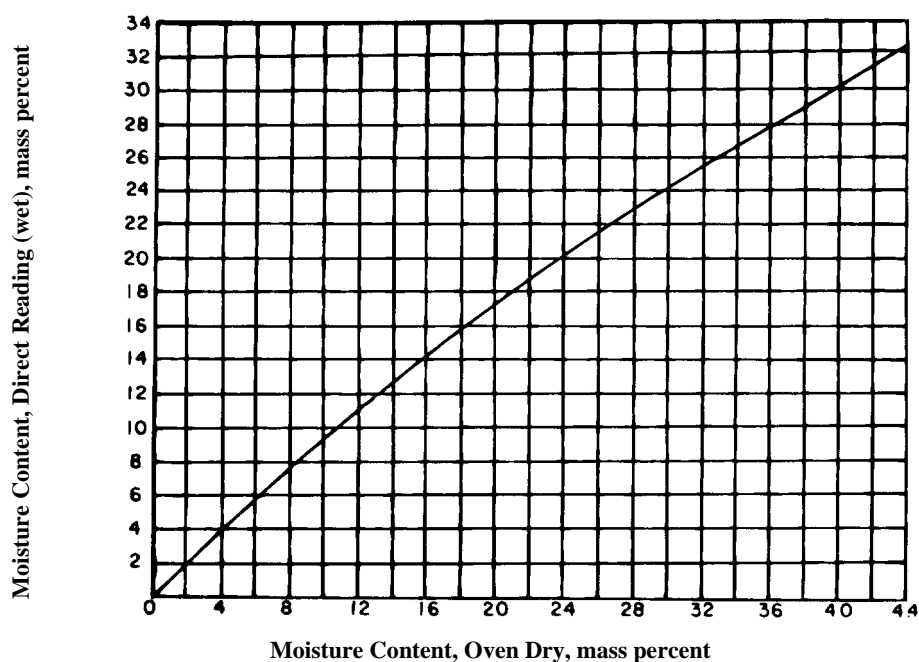
**Example:**

Gauge reading: 18.5

Conversion from chart: 22.1

Recorded % moisture: 22%

**Figure 1. Conversion Curve for Moisture Tester**



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**Report**

Results shall be reported on standard forms approved by the agency. Report moisture content to the nearest 1 percent.

**Tips!**

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- Follow the safety precautions suggested by the tester's manufacturer and by the maker of the calcium carbide reagent.
- Do not allow the steel balls to hit the cap or bottom of the pressure vessel.
- Remember to use the conversion chart or curves to determine moisture content based on dry mass of soil.

EMBANKMENT AND BASE  
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WAQTC

AASHTO T 217

## REVIEW QUESTIONS

1. For how long can calcium carbide be used? Indefinitely?
2. What safety precautions need to be taken in performing the test procedure?
3. How is moisture content related to the gauge reading?
4. For how long should the circular motion of the vessel continue?
5. After motion is completed, but before reading the gauge, what should be done?
6. What is the reported moisture content when your gauge reading is 14.6?





## PERFORMANCE EXAM CHECKLIST

### DETERMINATION OF MOISTURE IN SOILS BY MEANS OF CALCIUM CARBIDE GAS PRESSURE MOISTURE TESTER FOP FOR AASHTO T 217

Participant Name \_\_\_\_\_ Exam Date \_\_\_\_\_

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Shelf life of calcium carbide reagent checked?	_____	_____
2. Correct amount of reagent placed in body of vessel?	_____	_____
3. The correct number and size of steel balls introduced into the vessel?	_____	_____
4. Correct mass of moist soil placed in cap of vessel?	_____	_____
5. Cap clamped to body with vessel in horizontal position?	_____	_____
6. Soil allowed to fall from cap?	_____	_____
7. Motion performed properly (60 seconds, rest for 30 seconds, for up to three cycles)?	_____	_____
8. Motion performed without steel balls hitting cap or bottom of vessel?	_____	_____
9. Vessel allowed to cool?	_____	_____
10. Gauge on vessel stops moving.	_____	_____
11. Reading taken with vessel in horizontal position at eye level?	_____	_____
12. Sample mass and gauge reading recorded?	_____	_____
13. Tester positioned with cap away from user before gases slowly released?	_____	_____
14. Contents inspected for complete pulverization?	_____	_____
15. Gauge reading on wet mass basis converted to dry mass percent to nearest 1%?	_____	_____

Comments: \_\_\_\_\_ First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

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Examiner Signature \_\_\_\_\_ WAQTC #: \_\_\_\_\_